Appl. No.: 10/707,922
Amdt. Dated: 7/6/2007
Reply to Office action of: 04/18/2007

AMENDMENTS TO THE DRAWINGS:

There are no amendments to the drawings being presented herewith.

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REMARKS/ARGUMENTS

Claims 1 – 3, and 5 – 15 remain in this application. Claim 10 has been amended to more clearly claim Applicants' invention.

No new matter has been introduced by these amendments.

Claims 1, 3, 7, 8, 10, 12, and 15 were rejected under 35 U.S.C. 103(a) as being unpatentable over Gronbach (2003/0155814), Maeda (6,340,848), Akerson (6,344,985), and Mahvi (2003/0036823). Specifically, the Examiner states:

> Gronbach teaches a vehicle with a dual voltage electrical system comprising two networks at different voltage levels (42V and 14V), where each network can feed the other via a bi-directional DC—DC converter (22; [0010])). He also teaches several equal shunted DC/DC converters (20, 22) connecting the first and second networks connected to a common point. Both networks are fed via a battery (12 and 24) and one is connected to a generator (10). He also teaches loads not being able to be fully supported via one source, so converters, and the other network battery, help to provide support to the one network by supplying the extra power needs to supply to the loads ([0010]). He also teaches a control unit which controls the converters output to each load (last of [0012]) Gronbach fails to teach having each converter having its own set of loads nor does he teach protection means in some of the loads of each set. Maeda teaches a power distribution system in a vehicle comprising sets of 14V loads (normal load) and 42V loads (large capacity load) in different parts of the vehicle each connected to a distribution box containing a DC/DC converter corresponding to each set of loads. He also teaches fuses (31f, 31d, 33f, 33d, 35d, 35f) protecting the all loads in each set (Fig. 2). It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate a plurality of DC/DC converters assigned to particular sets of loads to minimize the amount of wires running through the system (Maeda – Col. 5, lines 34 – 42) and to have more accuracy with different sets of loads. It also would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate fuses into the

PAGE 11/30 * RCVD AT 7/6/2007 3:47:44 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-1/14 * DNIS:2738300 * CSID:360-838-6611 * DURATION (mm-ss):19-22

> load side of the converters to protect the loads from overcurrent or overvoltage.
>
> Gronbach fails to teach at least two bi-directional DC/DC converters being used in his electrical system. Akerson teaches an electrical system that could be used inn a vehicle having different voltage networks (Col. 1, lines 11 – 15). He goes on to teach the use of a plurality of bi-directional DC/DC converters (102a, 104a) in the system (Fig. 7). It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the plurality of bi-direction DC/DC converters of Akerson into the vehicle electrical system of the Gronbach/Maeda combination, so that the system can transfer power in either direction at a plurality of different points throughout the vehicle and therefore would minimize wires and also create a more efficient system in the case where power from one network needs to be supplied to the other at various point throughout the vehicle.
>
> Gronbach also fails to explicitly teach how the control unit communicates with the converters and the rest of the supply system. Mahvi teaches a vehicle control system using a high speed communications bus, for example, the CAN standard ([0032]). It would have been obvious to one of ordinary skill in the art at the time of the invention to use a CAN high speed communications bus since they are known to be used in the vehicles art and Gronbach was silent on this issue.

Applicant respectfully traverses this rejection. The key to Applicants' invention is providing an apparatus and method of providing dual voltage electrical systems in vehicles with power at both voltage levels through the utilization of more than two DC/DC converters where at least two of said DC/DC converters are two way converters. Furthermore, the claimed invention provides for the ability of either voltage level system to provide voltage to the other. Applicants' invention also teaches the critical feature of using a high speed bus to connect the plurality of DC/DC converters and a control unit to provide for the ability of protecting and providing necessary electrical flow during transient changes to the load requirements of the vehicle. In addition the ability of the loads to be protected by fuses even during an electrical flow interruption by one or more of the DC/DC converters is disclosed.

A fair reading of the Gronbach reference discloses the use of one or two, one-way DC/DC converters to allow a higher voltage and a lower voltage dual system in a vehicle to be charged by an outside power source which is of a voltage level different from both of the voltage levels of the onboard dual voltage system (see for example, paragraph [0003]). This reference further discloses the use of one step-down DC/DC converter from the outside reference voltage to the lower voltage level onboard and one step-up DC/DC converter to convert the reference voltage that is higher than the 14V level up to the higher 42V level of the onboard system (see for example paragraph [0004]). The whole point of the reference teaching is to allow an outside voltage source which has a voltage value lying between the upper and the lower voltages of the onboard system to charge both onboard systems as necessary with a simplified power point and a inexpensive jumper cable as well as to allow the outside power source to start the vehicle if necessary (see for example paragraphs [0005] and [0017]). The two DC/DC converters do not cooperate with one another only with the outside power source to allow the outside power source to charge either or both voltage level batteries or operate either or both of the voltage level loads (see for example paragraph [0012]). Figure 2 of the reference teaches the use of a polar relay to prevent direct connection of the outside reference voltage supply and the higher 42V voltage onboard system (see for example paragraph [0014]). Finally, this reference teaches the use of multiphase converters connected in parallel and controlled a clock time-staggered manner to allow the use the same set of DC/DC converters as both step-down and step-up converters (see for example paragraph [0016]). Thus, while the Gronbach reference at paragraph [0010] does indeed teach one 2 way DC/DC converter, it does so only in relation to paragraph [0011]. Further, both paragraphs [0010] and [0011] clearly specifically disclose that there is only one 2 way DC/DC converter and that said converter is located on the 14V side and that it is required because charging of the 42V side only at times when an outside 14V power source is being utilized (see for example, paragraph [0011], lines 5 – 9). There is no disclosure of charging the 42V side from the battery of the 14V side. The Gronbach reference does not disclose, teach, or fairly suggest how to use DC/DC converters to allow either the higher voltage level or lower voltage level of the onboard vehicle dual voltage system to charge the other or to power the others loads if necessary. Further, this reference does not disclose, teach, or fairly suggest the use of a high speed CAN or VAN bus. The Gronbach

reference also fails to provide the necessary impetus to direct one of ordinary skill in the art to combine the disclosed invention with other references to arrive at Applicant's claimed invention.

A fair reading of the Maeda reference discloses an on-vehicle distribution box and electrical power distribution system having only one voltage level (43V) system onboard, (see for example Col. 3, lines 24 – 36). This system utilizes DC/DC converters to convert the single voltage system to two separate voltages for use with loads having lower voltage than the single 42V system of the vehicle (see for example Col. 3, lines 46 – 58) and all of the converters are step-down converters only (see for example Col. 4, lines 63 – 67). The reference further discloses that each power sector in the vehicle has only one DC/DC step-down converter (see for example Col. 3, lines 46 – 59 and Col. 4, lines 12 – 19)). The disclosure also teaches lower voltage control fuses all being located down stream from the DC/DC converter making the fuses inoperative and not able to protect their associated loads when the DC/DC converter shuts down to protect itself or the DC/DC converters must be sacrificial to allow the fuses to continue to protect the associated loads (see for example Col. 4, lines 20 – 47 and Col. 6, lines 15 – 23, and Fig. 2). Clearly the Maeda reference does not teach the use of DC/DC converters in a dual voltage source onboard vehicle system but instead the use of single DC/DC step down convert in each electrical sector requiring lower voltage than the single 42V voltage system of a single voltage onboard vehicle system. Further this reference does not teach how to use both step down and step-up DC/DC converters to allow voltage of either a higher level from a lower voltage level on board system or a lower level from a higher voltage level on board system to be interconnected as necessary to maintain both voltage level systems in the vehicle (see for example the single voltage level system of Fig. 2). The Maeda reference also does not provide the necessary impetus to one skilled in the art to modify this single onboard voltage level system to a dual voltage level onboard system and even if it did, which it does not, it does not suggest how to reach Applicant's claimed invention.

A fair reading of the Akerson reference discloses the use of multiple power input bi-directional power converter where the input batteries may be of different voltage ratings but the output power of the converter is a single voltage controlled by at least one capacitor (see for example, Col. 4, lines 22 – 47, and Col. 5, lines 6 – 25). Thus, the loads

of the Akerson reference are all contemplated to have the same voltage requirement if they are to run directly from a converter within an array of converters (see for example, Figs. 1 and 4). A critical element in the Akerson reference teaching is the use of a medium capacitor for a single value voltage output (see for example, Col. 4, lines 27 – 31, Fig. 1, 112a). Thus, while batteries of different voltages may be used as multiple power sources and may even be recharged at different voltages, the power source for each converter circuit can have only one voltage value input and the power converter of Akerson outputs only a single voltage value (see for example, Figs. 1 and 4). This reference also teaches that you can have multiple converters connected to a single voltage source but not the other way around (see for example, Fig. 8). The Akerson reference does not disclose, teach, or fairly suggest how to provide multiple voltage outputs using at least two bi-directional converters each having a different voltage input. Furthermore, there is no affirmative impetus within this reference to suggest it is combinable with DC/DC converters where each converter is powered by batteries having different voltage and also provide different voltage outputs. Clearly the Akerson reference does not teach the use of DC/DC converters in a dual voltage source onboard vehicle system to provide power to loads of two different voltages but instead the use of multiple converters each which has a single DC input voltage source wherein each converters single voltage value input may be of a different voltage from the other converters in the system.

A fair reading of the Mahvi reference discloses the use of a vehicle control system that may be plugged into a vehicle electrical system bus including a CAN bus. However, this reference does not disclose, teach, or fairly suggest anything about dual voltage systems or suggest any use of this invention for dual voltage system applications. In fact, this reference teaches nothing about vehicle electrical systems at all other than the fact you can use them to provide power to electrical devices in a vehicle. Thus, the Mahvi reference does not provide the necessary impetus to one skilled in the art to modify any type of dual voltage system in any way. Clearly, without having prior knowledge of Applicants' one skilled in the art would have absolutely no reason to look to an engine disablement device for dual voltage electrical system design and function.

Clearly, when viewed in this light the Gronbach reference, the Maeda reference, the Akerson reference, the Mahvi reference, and any combination thereof do not disclose, teach, or fairly suggest the dual voltage electrical supply system utilizing at least three

DC/DC converters of which at least two are two way converters capable of providing electrical voltage even during transient changes in the loads and providing fuse protection of the loads of Applicants' present invention. Furthermore, the admission by the Examiner that the reference are "...silent on this issue." is not the test of a proper combination is well settled in the law which requires that there be a "necessary impetus" within the four corners of the references themselves that would suggest to one skilled in the art to make the suggested combination without prior knowledge of the claimed invention. Applicants' submit that silence does not create the "necessary impetus".

Claims 2, 9, and 11 were rejected under 35 U.S.C. 103(a) as being unpatentable over Gronbach (2003/0155814), Maeda (6,340,848), Akerson (6,344,985), and Mahvi (2003/0036823) as applied to claims 1 and 10 above, and further in view of Nonaka (JP 08-111932 A). Specifically, the Examiner states:

> Gronbach, Maeda, Akerson, and Mahvi teach a vehicle power distribution system as described above. Gronbach teaches a controller that controls the output of the converters (last of [0012]). Maeda teaches each set of 42V loads each being associated with a DC/DC converter. Gronbach fails to explicitly teach detecting the current required by the loads. Nonaka teaches detecting the power requirement of a load. It would have been obvious to one of ordinary skill in the art at the time of the invention to, via some point in the circuit, detect the current required by each load, so that Gronbach's controller will know what voltage to output from the converters to properly feed the loads.

Applicant respectfully traverses this rejection. The key to Applicants' invention, as mentioned above, is providing an apparatus and method of providing dual voltage electrical systems in vehicles with power at both voltage levels through the utilization of more than two DC/DC converters where at least two of said DC/DC converters are two way converters. Furthermore, the claimed invention provides for the ability of either voltage level system to provide voltage to the other. Applicants' invention also teaches the critical feature of using a high speed bus to connect the plurality of DC/DC converters and a control unit to provide for the ability of protecting and providing necessary electrical flow during transient changes to the load requirements of the vehicle. In

addition the ability of the loads to be protected by fuses even during an electrical flow interruption by one or more of the DC/DC converters is disclosed.

A fair reading of the Gronbach reference, as mentioned above, discloses the use of one or two, one-way DC/DC converters to allow a higher voltage and a lower voltage dual system in a vehicle to be charged by an outside power source which is of a voltage level different from both of the voltage levels of the onboard dual voltage system (see for example, paragraph [0003]). This reference further discloses the use of one step-down DC/DC converter from the outside reference voltage to the lower voltage level onboard and one step-up DC/DC converter to convert the reference voltage that is higher than the 14V level up to the higher 42V level of the onboard system (see for example paragraph [0004]). The whole point of the reference teaching is to allow an outside voltage source which has a voltage value lying between the upper and the lower voltages of the onboard system to charge both onboard systems as necessary with a simplified power point and a inexpensive jumper cable as well as to allow the outside power source to start the vehicle if necessary (see for example paragraphs [0005] and [0017]). The two DC/DC converters do not cooperate with one another only with the outside power source to allow the outside power source to charge either or both voltage level batteries or operate either or both of the voltage level loads(seeforexampleparagraph [0012]). Figure 2 of the reference teaches the use of a polar relay to prevent direct connection of the outside reference voltage supply and the higher 42V voltage onboard system (see for example paragraph [0014]). Finally, this reference teaches the use of multiphase converters connected in parallel and controlled a clock time-staggered manner to allow the use the same set of DC/DC converters as both step-down and step-up converters (see for example paragraph [0016]). Thus, while the Gronbach reference at paragraph [0010] does indeed teach one 2 way DC/DC converter, it does so only in relation to paragraph [0011]. Further, both paragraphs [0010] and [0011] clearly specifically disclose that there is only one 2 way DC/DC converter and that said converter is located on the 14V side and that it is required because charging of the 42V side only at times when an outside 14V power source is being utilized (see for example, paragraph [0011], lines 5 – 9). There is no disclosure of charging the 42V side from the battery of the 14V side. The Gronbach reference does not disclose, teach, or fairly suggest how to use DC/DC converters to allow either the higher voltage level or lower voltage level of the onboard vehicle dual

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voltage system to charge the other or to power the others loads if necessary. Further, this reference does not disclose, teach, or fairly suggest the use of a high speed CAN or VAN bus. The Gronbach reference also fails to provide the necessary impetus to direct one of ordinary skill in the art to combine the disclosed invention with other references to arrive at Applicant's claimed invention.

A fair reading of the Maeda reference, as mentioned above, discloses an on-vehicle distribution box and electrical power distribution system having only one voltage level (43V) system onboard, (see for example Col. 3, lines 24 – 36). This system utilizes DC/DC converters to convert the single voltage system to two separate voltages for use with loads having lower voltage than the single 42V system of the vehicle (see for example Col. 3, lines 46 – 58) and all of the converters are step-down converters only (see for example Col. 4, lines 63 – 67). The reference further discloses that each power sector in the vehicle has only one DC/DC step-down converter (see for example Col. 3, lines 46 – 59 and Col. 4, lines 12 – 19)). The disclosure also teaches lower voltage control fuses all being located down stream from the DC/DC converter making the fuses inoperative and not able to protect their associated loads when the DC/DC converter shuts down to protect itself or the DC/DC converters must be sacrificial to allow the fuses to continue to protect the associated loads (see for example Col. 4, lines 20 – 47 and Col. 6, lines 15 – 23, and Fig. 2). Clearly the Maeda reference does not teach the use of DC/DC converters in a dual voltage source onboard vehicle system but instead the use of single DC/DC step down convert in each electrical sector requiring lower voltage than the single 42V voltage system of a single voltage onboard vehicle system. Further this reference does not teach how to use both step down and step-up DC/DC converters to allow voltage of either a higher level from a lower voltage level on board system or a lower level from a higher voltage level on board system to be interconnected as necessary to maintain both voltage level systems in the vehicle (see for example the single voltage level system of Fig. 2). The Maeda reference also does not provide the necessary impetus to one skilled in the art to modify this single onboard voltage level system to a dual voltage level onboard system and even if it did, which it does not, it does not suggest how to reach Applicant's claimed invention.

A fair reading of the Akerson reference, as mentioned above, discloses the use of multiple power input bi-directional power converter where the input batteries may be of

different voltage ratings but the output power of the converter is a single voltage controlled by at least one capacitor (see for example, Col. 4, lines 22 – 47, and Col. 5, lines 6 – 25). Thus, the loads of the Akerson reference are all contemplated to have the same voltage requirement if they are to run directly from a converter within an array of converters (see for example, Figs. 1 and 4). A critical element in the Akerson reference teaching is the use of a medium capacitor for a single value voltage output (see for example, Col. 4, lines 27 – 31, Fig. 1, 112a). Thus, while batteries of different voltages may be used as multiple power sources and may even be recharged at different voltages, the power source for each converter circuit can have only one voltage value input and the power converter of Akerson outputs only a single voltage value (see for example, Figs. 1 and 4). This reference also teaches that you can have multiple converters connected to a single voltage source but not the other way around (see for example, Fig. 8). The Akerson reference does not disclose, teach, or fairly suggest how to provide multiple voltage outputs using at least two bi-directional converters each having a different voltage input. Furthermore, there is no affirmative impetus within this reference to suggest it is combinable with DC/DC converters where each converter is powered by batteries having different voltage and also provide different voltage outputs. Clearly the Akerson reference does not teach the use of DC/DC converters in a dual voltage source onboard vehicle system to provide power to loads of two different voltages but instead the use of multiple converters each which has a single DC input voltage source wherein each converters single voltage value input may be of a different voltage from the other converters in the system.

A fair reading of the Mahvi reference, as mentioned above, discloses the use of a vehicle control system that may be plugged into a vehicle electrical system bus including a CAN bus. However, this reference does not disclose, teach, or fairly suggest anything about dual voltage systems or suggest any use of this invention for dual voltage system applications. In fact, this reference teaches nothing about vehicle electrical systems at all other than the fact you can use them to provide power to electrical devices in a vehicle. Thus, the Mahvi reference does not provide the necessary impetus to one skilled in the art to modify any type of dual voltage system in any way. Clearly, without having prior knowledge of Applicants' one skilled in the art would have absolutely no

reason to look to an engine disablement device for dual voltage electrical system design and function.

A fair reading of the Nonaka reference English language abstract discloses the use of a DC/DC converter to change the output voltage of a single voltage level power supply. It teaches the use of a microcomputer to switch the DC/DC converter state (see whole English translation of abstract). There is no disclosure, teaching, or fair suggestion of using the disclosed battery charger to control dual level voltage systems in vehicles, or how to use more than one DC/DC converter, or the use of multi-stage converts in parallel. Quite simply this reference does not teach one skilled in the art anything about dual voltage systems in vehicles or how to adapt it to such a use. Furthermore, nowhere is there the necessary impetus to suggest to one of ordinary skill in the art to combine it with the Gronbach and/or the Maeda references to reach Applicants' claimed invention.

Clearly, when viewed in this light the Gronbach reference, the Maeda reference, the Akerson reference, the Mahvi reference, the Nonaka reference, and any combination thereof do not disclose, teach, or fairly suggest the dual voltage electrical supply system utilizing at least three DC/DC converters of which at least two are two way converters capable of providing electrical voltage even during transient changes in the loads and providing fuse protection of the loads of Applicants' present invention. Furthermore, the admission by the Examiner that the reference are "... silent on this issue." is not the test of a proper combination is well settled in the law which requires that there be a "necessary impetus" within the four corners of the references themselves that would suggest to one skilled in the art to make the suggested combination without prior knowledge of the claimed invention. Applicants' submit that silence does not create the "necessary impetus".

Claims 5 and 6 were rejected under 35 U.S.C. 103(a) as being unpatentable over Gronbach(2003/0155814),Maeda(6,340,848), Akerson (6,344,985), and Mahvi (2003/0036823) as applied to claim 1 above, and further in view of Tamai et al. (2002/0190690). Specifically, the Examiner states:

> Gronbach, Maeda, Akerson, and Mahvi teach a vehicle power distribution system as described above. They fail to teach the use of fuses and switches as protecting means for the loads. Tamai teaches the use of both fuses and controlled switches (22 – 225) as protection means (Fig. 1).

> It would have been obvious to one of ordinary skill in the art at the time of the invention to implement fuses and switches into some of the load circuits to include extra protection against overcurrent and overvoltage.

Applicant respectfully traverses this rejection. The key to Applicants' invention, as mentioned above, is providing an apparatus and method of providing dual voltage electrical systems in vehicles with power at both voltage levels through the utilization of more than two DC/DC converters where at least two of said DC/DC converters are two way converters. Furthermore, the claimed invention provides for the ability of either voltage level system to provide voltage to the other. Applicants' invention also teaches the critical feature of using a high speed bus to connect the plurality of DC/DC converters and a control unit to provide for the ability of protecting and providing necessary electrical flow during transient changes to the load requirements of the vehicle. In addition the ability of the loads to be protected by fuses even during an electrical flow interruption by one or more of the DC/DC converters is disclosed.

A fair reading of the Gronbach reference, as mentioned above, discloses the use of one or two, one-way DC/DC converters to allow a higher voltage and a lower voltage dual system in a vehicle to be charged by an outside power source which is of a voltage level different from both of the voltage levels of the onboard dual voltage system (see for example, paragraph [0003]). This reference further discloses the use of one step-down DC/DC converter from the outside reference voltage to the lower voltage level onboard and one step-up DC/DC converter to convert the reference voltage that is higher than the 14V level up to the higher 42V level of the onboard system (see for example paragraph [0004]). The whole point of the reference teaching is to allow an outside voltage source which has a voltage value lying between the upper and the lower voltages of the onboard system to charge both onboard systems as necessary with a simplified power point and a inexpensive jumper cable as well as to allow the outside power source to start the vehicle if necessary (see for example paragraphs [0005] and [0017]). The two DC/DC converters do not cooperate with one another only with the outside power source to allow the outside power source to charge either or both voltage level batteries or operate either or both of the voltage level loads(seeforexampleparagraph [0012]). Figure 2 of the reference teaches the use of a polar relay to prevent direct connection of the outside reference voltage supply and the higher 42V voltage onboard system (see for example

paragraph [0014]). Finally, this reference teaches the use of multiphase converters connected in parallel and controlled a clock time-staggered manner to allow the use the same set of DC/DC converters as both step-down and step-up converters (see for example paragraph [0016]). Thus, while the Gronbach reference at paragraph [0010] does indeed teach one 2 way DC/DC converter, it does so only in relation to paragraph [0011]. Further, both paragraphs [0010] and [0011] clearly specifically disclose that there is only one 2 way DC/DC converter and that said converter is located on the 14V side and that it is required because charging of the 42V side only at times when an outside 14V power source is being utilized (see for example, paragraph [0011], lines 5 – 9). There is no disclosure of charging the 42V side from the battery of the 14V side. The Gronbach reference does not disclose, teach, or fairly suggest how to use DC/DC converters to allow either the higher voltage level or lower voltage level of the onboard vehicle dual voltage system to charge the other or to power the others loads if necessary. Further, this reference does not disclose, teach, or fairly suggest the use of a high speed CAN or VAN bus. The Gronbach reference also fails to provide the necessary impetus to direct one of ordinary skill in the art to combine the disclosed invention with other references to arrive at Applicant's claimed invention.

A fair reading of the Maeda reference, as mentioned above, discloses an on-vehicle distribution box and electrical power distribution system having only one voltage level (43V) system onboard, (see for example Col. 3, lines 24 – 36). This system utilizes DC/DC converters to convert the single voltage system to two separate voltages for use with loads having lower voltage than the single 42V system of the vehicle (see for example Col. 3, lines 46 – 58) and all of the converters are step-down converters only (see for example Col. 4, lines 63 – 67). The reference further discloses that each power sector in the vehicle has only one DC/DC step-down converter (see for example Col. 3, lines 46 – 59 and Col. 4, lines 12 – 19)). The disclosure also teaches lower voltage control fuses all being located down stream from the DC/DC converter making the fuses inoperative and not able to protect their associated loads when the DC/DC converter shuts down to protect itself or the DC/DC converters must be sacrificial to allow the fuses to continue to protect the associated loads (see for example Col. 4, lines 20 – 47 and Col. 6, lines 15 – 23, and Fig. 2). Clearly the Maeda reference does not teach the use of DC/DC converters in a dual voltage source onboard vehicle system but instead the use of

single DC/DC step down convert in each electrical sector requiring lower voltage than the single 42V voltage system of a single voltage onboard vehicle system. Further this reference does not teach how to use both step down and step-up DC/DC converters to allow voltage of either a higher level from a lower voltage level on board system or a lower level from a higher voltage level on board system to be interconnected as necessary to maintain both voltage level systems in the vehicle (see for example the single voltage level system of Fig. 2). The Maeda reference also does not provide the necessary impetus to one skilled in the art to modify this single onboard voltage level system to a dual voltage level onboard system and even if it did, which it does not, it does not suggest how to reach Applicant's claimed invention.

A fair reading of the Akerson reference, as mentioned above, discloses the use of multiple power input bi-directional power converter where the input batteries may be of different voltage ratings but the output power of the converter is a single voltage controlled by at least one capacitor (see for example, Col. 4, lines 22 – 47, and Col. 5, lines 6 – 25). Thus, the loads of the Akerson reference are all contemplated to have the same voltage requirement if they are to run directly from a converter within an array of converters (see for example, Figs. 1 and 4). A critical element in the Akerson reference teaching is the use of a medium capacitor for a single value voltage output (see for example, Col. 4, lines 27 – 31, Fig. 1, 112a). Thus, while batteries of different voltages may be used as multiple power sources and may even be recharged at different voltages, the power source for each converter circuit can have only one voltage value input and the power converter of Akerson outputs only a single voltage value (see for example, Figs. 1 and 4). This reference also teaches that you can have multiple converters connected to a single voltage source but not the other way around (see for example, Fig. 8). The Akerson reference does not disclose, teach, or fairly suggest how to provide multiple voltage outputs using at least two bi-directional converters each having a different voltage input. Furthermore, there is no affirmative impetus within this reference to suggest it is combinable with DC/DC converters where each converter is powered by batteries having different voltage and also provide different voltage outputs. Clearly the Akerson reference does not teach the use of DC/DC converters in a dual voltage source onboard vehicle system to provide power to loads of two different voltages but instead the use of multiple converters each which has a single DC input voltage source wherein each

converters single voltage value input may be of a different voltage from the other converters in the system.

A fair reading of the Mahvi reference, as mentioned above, discloses the use of a vehicle control system that may be plugged into a vehicle electrical system bus including a CAN bus. However, this reference does not disclose, teach, or fairly suggest anything about dual voltage systems or suggest any use of this invention for dual voltage system applications. In fact, this reference teaches nothing about vehicle electrical systems at all other than the fact you can use them to provide power to electrical devices in a vehicle. Thus, the Mahvi reference does not provide the necessary impetus to one skilled in the art to modify any type of dual voltage system in any way. Clearly, without having prior knowledge of Applicants' one skilled in the art would have absolutely no reason to look to an engine disablement device for dual voltage electrical system design and function.

A fair reading of the Tamai et al. (2002/0190690) reference discloses the use of a single one way DC/DC converter from the high voltage side to the low voltage side only. The teaching of determining the SOC of the high voltage battery only (see for example, paragraphs [0054], [0059], and [0060]) but does not disclose, teach, or fairly suggest the use of more than one two way DC/DC converters nor the desirability to determine the SOC of both the high voltage and the low voltage batteries. Furthermore, this reference teaches the charging by the generator of the high voltage battery only (see for example, paragraph [0030]). The Tamai et al. reference does not disclose, teach, or fairly suggest how one skilled in the art should combine this reference with references using more than one DC/DC converter, or how to apply it to dual voltage systems that convert both from high voltage to low voltage and from low voltage to high voltage as required. Clearly, when viewed in this light the Tamai et al. reference does not disclose, teach, or fairly suggest Applicants' claimed invention. Nor does it provide the legally required impetus to direct one skilled in the art to such a combination.

Clearly, when viewed in this light the Gronbach reference, the Maeda reference, the Akerson reference, the Mahvi reference, the Tamai et al. reference, and any combination thereof do not disclose, teach, or fairly suggest the dual voltage electrical supply system utilizing at least three DC/DC converters of which at least two are two way converters capable of providing electrical voltage even during transient changes in

the loads and providing fuse protection of the loads of Applicants' present invention. Furthermore, the admission by the Examiner that the reference are "...silent on this issue." is not the test of a proper combination is well settled in the law which requires that there be a "necessary impetus" within the four corners of the references themselves that would suggest to one skilled in the art to make the suggested combination without prior knowledge of the claimed invention. Applicants' submit that silence does not create the "necessary impetus".

Claims 13 and 14 were rejected under 35 U.S.C. 103(a) as being unpatentable over Gronbach (2003/0155814), Maeda (6,340,848), Akerson (6,344,985), Mahvi (2003/0036823), and Tamai et al. (2002/0190690) as applied to claims 1, 5, and 6 above, and further in view of Beihoff et al. (2003/0132042). Specifically, the Examiner states:

> Gronbach, Maeda, Akerson, Mahvi, and Tamai teach a vehicle power distribution system as described above. They fail to explicitly teach the type of switches used as protection means. Beihoff teaches the use of power switches in vehicle systems, such as FETs ([0004]). It would have been obvious to one of ordinary skill in the art at the time of the invention to use FETs as the switches in the above invention since FETs are known to be used in the vehicle art, and the other references were silent on this issue.

Applicant respectfully traverses this rejection. The key to Applicants' invention, as mentioned above, is providing an apparatus and method of providing dual voltage electrical systems in vehicles with power at both voltage levels through the utilization of more than two DC/DC converters where at least two of said DC/DC converters are two way converters. Furthermore, the claimed invention provides for the ability of either voltage level system to provide voltage to the other. Applicants' invention also teaches the critical feature of using a high speed bus to connect the plurality of DC/DC converters and a control unit to provide for the ability of protecting and providing necessary electrical flow during transient changes to the load requirements of the vehicle. In addition the ability of the loads to be protected by fuses even during an electrical flow interruption by one or more of the DC/DC converters is disclosed.

A fair reading of the Gronbach reference, as mentioned above, discloses the use of one or two, one-way DC/DC converters to allow a higher voltage and a lower voltage

dual system in a vehicle to be charged by an outside power source which is of a voltage level different from both of the voltage levels of the onboard dual voltage system (see for example, paragraph [0003]). This reference further discloses the use of one step-down DC/DC converter from the outside reference voltage to the lower voltage level onboard and one step-up DC/DC converter to convert the reference voltage that is higher than the 14V level up to the higher 42V level of the onboard system (see for example paragraph [0004]). The whole point of the reference teaching is to allow an outside voltage source which has a voltage value lying between the upper and the lower voltages of the onboard system to charge both onboard systems as necessary with a simplified power point and a inexpensive jumper cable as well as to allow the outside power source to start the vehicle if necessary (see for example paragraphs [0005] and [0017]). The two DC/DC converters do not cooperate with one another only with the outside power source to allow the outside power source to charge either or both voltage level batteries or operate either or both of the voltage level loads(seeforexampleparagraph [0012]). Figure 2 of the reference teaches the use of a polar relay to prevent direct connection of the outside reference voltage supply and the higher 42V voltage onboard system (see for example paragraph [0014]). Finally, this reference teaches the use of multiphase converters connected in parallel and controlled a clock time-staggered manner to allow the use the same set of DC/DC converters as both step-down and step-up converters (see for example paragraph [0016]). Thus, while the Gronbach reference at paragraph [0010] does indeed teach one 2 way DC/DC converter, it does so only in relation to paragraph [0011]. Further, both paragraphs [0010] and [0011] clearly specifically disclose that there is only one 2 way DC/DC converter and that said converter is located on the 14V side and that it is required because charging of the 42V side only at times when an outside 14V power source is being utilized (see for example, paragraph [0011], lines 5 – 9). There is no disclosure of charging the 42V side from the battery of the 14V side. The Gronbach reference does not disclose, teach, or fairly suggest how to use DC/DC converters to allow either the higher voltage level or lower voltage level of the onboard vehicle dual voltage system to charge the other or to power the others loads if necessary. Further, this reference does not disclose, teach, or fairly suggest the use of a high speed CAN or VAN bus. The Gronbach reference also fails to provide the necessary impetus to direct one of

ordinary skill in the art to combine the disclosed invention with other references to arrive at Applicant's claimed invention.

A fair reading of the Maeda reference, as mentioned above, discloses an on-vehicle distribution box and electrical power distribution system having only one voltage level (43V) system onboard, (see for example Col. 3, lines 24 – 36). This system utilizes DC/DC converters to convert the single voltage system to two separate voltages for use with loads having lower voltage than the single 42V system of the vehicle (see for example Col. 3, lines 46 – 58) and all of the converters are step-down converters only (see for example Col. 4, lines 63 – 67). The reference further discloses that each power sector in the vehicle has only one DC/DC step-down converter (see for example Col. 3, lines 46 – 59 and Col. 4, lines 12 – 19)). The disclosure also teaches lower voltage control fuses all being located down stream from the DC/DC converter making the fuses inoperative and not able to protect their associated loads when the DC/DC converter shuts down to protect itself or the DC/DC converters must be sacrificial to allow the fuses to continue to protect the associated loads (see for example Col. 4, lines 20 – 47 and Col. 6, lines 15 – 23, and Fig. 2). Clearly the Maeda reference does not teach the use of DC/DC converters in a dual voltage source onboard vehicle system but instead the use of single DC/DC step down convert in each electrical sector requiring lower voltage than the single 42V voltage system of a single voltage onboard vehicle system. Further this reference does not teach how to use both step down and step-up DC/DC converters to allow voltage of either a higher level from a lower voltage level on board system or a lower level from a higher voltage level on board system to be interconnected as necessary to maintain both voltage level systems in the vehicle (see for example the single voltage level system of Fig. 2). The Maeda reference also does not provide the necessary impetus to one skilled in the art to modify this single onboard voltage level system to a dual voltage level onboard system and even if it did, which it does not, it does not suggest how to reach Applicant's claimed invention.

A fair reading of the Akerson reference, as mentioned above, discloses the use of multiple power input bi-directional power converter where the input batteries may be of different voltage ratings but the output power of the converter is a single voltage controlled by at least one capacitor (see for example, Col. 4, lines 22 – 47, and Col. 5, lines 6 – 25). Thus, the loads of the Akerson reference are all contemplated to have the

same voltage requirement if they are to run directly from a converter within an array of converters (see for example, Figs. 1 and 4). A critical element in the Akerson reference teaching is the use of a medium capacitor for a single value voltage output (see for example, Col. 4, lines 27 – 31, Fig. 1, 112a). Thus, while batteries of different voltages may be used as multiple power sources and may even be recharged at different voltages, the power source for each converter circuit can have only one voltage value input and the power converter of Akerson outputs only a single voltage value (see for example, Figs. 1 and 4). This reference also teaches that you can have multiple converters connected to a single voltage source but not the other way around (see for example, Fig. 8). The Akerson reference does not disclose, teach, or fairly suggest how to provide multiple voltage outputs using at least two bi-directional converters each having a different voltage input. Furthermore, there is no affirmative impetus within this reference to suggest it is combinable with DC/DC converters where each converter is powered by batteries having different voltage and also provide different voltage outputs. Clearly the Akerson reference does not teach the use of DC/DC converters in a dual voltage source onboard vehicle system to provide power to loads of two different voltages but instead the use of multiple converters each which has a single DC input voltage source wherein each converters single voltage value input may be of a different voltage from the other converters in the system.

A fair reading of the Mahvi reference, as mentioned above, discloses the use of a vehicle control system that may be plugged into a vehicle electrical system bus including a CAN bus. However, this reference does not disclose, teach, or fairly suggest anything about dual voltage systems or suggest any use of this invention for dual voltage system applications. In fact, this reference teaches nothing about vehicle electrical systems at all other than the fact you can use them to provide power to electrical devices in a vehicle. Thus, the Mahvi reference does not provide the necessary impetus to one skilled in the art to modify any type of dual voltage system in any way. Clearly, without having prior knowledge of Applicants' one skilled in the art would have absolutely no reason to look to an engine disablement device for dual voltage electrical system design and function.

A fair reading of the Tamai et al. (2002/0190690) reference, as mentioned above, discloses the use of a single one way DC/DC converter from the high voltage side to the low voltage side only. The teaching of determining the SOC of the high voltage battery

only (see for example, paragraphs [0054], [0059], and [0060]) but does not disclose, teach, or fairly suggest the use of more than one two way DC/DC converters nor the desirability to determine the SOC of both the high voltage and the low voltage batteries. Furthermore, this reference teaches the charging by the generator of the high voltage battery only (see for example, paragraph [0030]). The Tamai et al. reference does not disclose, teach, or fairly suggest how one skilled in the art should combine this reference with references using more than one DC/DC converter, or how to apply it to dual voltage systems that convert both from high voltage to low voltage and from low voltage to high voltage as required. Clearly, when viewed in this light the Tamai et al. reference does not disclose, teach, or fairly suggest Applicants' claimed invention. Nor does it provide the legally required impetus to direct one skilled in the art to such a combination.

A fair reading of the Beihoff et al. (2003/0132042) reference discloses a drive train assembly for the electrical drive train of a vehicle or the electrical drive train side of a hybrid vehicle comprising a base which can be externally cooled and can have located thereon the various necessary electrical components including DC/AC inverters (see for example, paragraphs [0011], lines 1 – 6, and paragraph [0053], lines 17 – 18). In addition, it teaches that this assembly can reduce the need for a bus (see for example, paragraph [0011], lines 6 – 7). The Beihoff et al. reference does not disclose the use of DC/DC converters at all, and it does not disclose the use of multiple converters or a dual voltage DC system. In fact, it is directed to AC electrical systems charged from DC systems such that there can be efficient electrical drive train propulsion of an electrically driven vehicle or a combustion engine/electrical drive train hybrid vehicle. The fact that this reference uses FETs for their intended purpose does not provide the required impetus for one skilled in the art to direct a combination with the other cited references without first having knowledge of Applicant's claimed invention.

Clearly, when viewed in this light the Gronbach reference, the Maeda reference, the Akerson reference, the Mahvi reference, the Tamai et al. reference, the Beihoff et al. reference, and any combination thereof do not disclose, teach, or fairly suggest the dual voltage electrical supply system utilizing at least three DC/DC converters of which at least two are two way converters capable of providing electrical voltage even during transient changes in the loads and providing fuse protection of the loads of Applicants' present invention. Furthermore, the admission by the Examiner that the reference are

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"... silent on this issue." is not the test of a proper combination is well settled in the law which requires that there be a "necessary impetus" within the four corners of the references themselves that would suggest to one skilled in the art to make the suggested combination without prior knowledge of the claimed invention. Applicants' submit that silence does not create the "necessary impetus".

In view of the remarks herein, and the amendments hereto, it is submitted that this application is in condition for allowance, and such action and issuance of a timely Notice of Allowance is respectfully solicited.

Respectfully submitted,

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